State of Illinois

Department of Registration and Education

State Geological Survey Division
Urbana, Illinois

John C. Frye, Chief

Guide Leaflet 54-F

PINCKNEYVILLE AREA
Perry County
Pinckneyville and Murphysboro
Quadrangles

EARTH SCIENCE FIELD TRIP

October 16, 1954

Leader: George M. Wilson

Host: Pinckneyville Community High School

ITINERARY

Distance	Mileage	
0	0	Assemble at Pinckneyville Community High School. Head cars east in school driveway.
2.4	2.4	STOP NO. I Till-plain. Note the flatness of the area.

This area is typical of the Illinoian till-plain. Drainage systems in the secondary streams are well developed. The principal streams have low gradients and occupy broad valleys in which the rivers have deposited alluvium. The Beaucoup Creek valley has lake silts, showing that the stream was ponded at some time.

Thousands of years ago most of Illinois was covered by huge ice-sheets. The most extensive of the ice-sheets, the Illinoian, covered the Pinckneyville area. The deposits that cover this plain were left by that glacier.

The reason the glaciers developed is not understood, but surely the mean annual temperatures were lower than those we have today. The snows that accumulated in the northern portion of North America did not melt entirely during the summers, and as a result the accumulated snows formed mammoth ice-sheets. Under the accumulated weight, the outer and lowermost portions of the ice-sheet moved outward. The ice-sheet carried with it rocks and soil over which it passed. This process continued for long periods and brought rocks into Illinois from as far north as central Canada. Glacial deposits are found as far south as Missouri and Ohio rivers.

When the temperatures became moderate, the forward advance of the glacier halted. For a while the melting of the ice balanced the accumulation and expansion, so that the margin of the glacier remained stationary. Later the ice melted faster than the glacier expanded, so that the ice front gradually melted back until the glacier disappeared entirely.

As the glacier melted, all of the soil and rocks which it had picked up as it advanced were released. Some of this material or drift was deposited in place as the ice melted. Such material is a thorough mixture of all kinds and sizes of rocks and is known as till. Some of the glacial drift was washed out with the glacial metl-water and so was sorted as the melt-water dropped its load. The coarest outwash material was deposited nearest the ice-front, the finer material was deposited farther away, and the finest clay may have been carried all the way to the ocean. Where the outwash material was spread widely in front of the glacier, it forms an outwash-plain; where it was concentrated in the drainage valleys, it forms valley-trains.

At times, especially during the winters when the melt-waters subsided, the outwash-plains and valley-trains were exposed.

Then the wind picked up the silt and fine sand from their surfaces, blew it across the country, and dropped it to form deposits known as loess. Glacial loess mantles most of Illinois. Near large river valleys the loess on the uplands may be as much as 60 to 80 feet thick, as for example on the hills north of Belleville. But far from the valleys the loess may be only a few inches thick, if it can be identified at all.

We recognize four major periods of glaciation during the Pleistocene or Great Ice Age (see accompanying table) and we know that after each glaciation there was a long interglacial period in which conditions were much as we know them today. From the glacial deposits we know that during each major glaciation the ice advanced and retreated many times. This was particularly true during the last or Wisconsin glacial stage.

The glacial drift we see in the Pinckneyville area is of Illinoian age. Possibly some of the deposits we will see today also include drift of Kansan age. The coal-mine strip pits show cross-sections of both glacial deposits and bedrock.

The position of the ice-front at each advance of the glacier is usually marked by a ridge of drift or a moraine. The moraine is the thick belt of drift that accumulated at the ice margin while the ice advance and melting remained essentially in balance. When the ice melted faster than the glacier advanced, so that the ice-front retreated, the resulting drift deposits form a drift-plain or till-plain. The surface of a till-plain may be almost level or somewhat billowy. We are on a till-plain now.

As a glacier began to recede, melt-water accumulated in local ponds or lakelets between the ice-front and the last moraine formed, except where there were low places across the moraine through which the melt-waters could drain. Valley-trains of outwash in the main river valleys formed dams across the mouths of tributary streams, so that the tributary valleys also became ponds or lakes. This happened twice in the Beaucoup Creek and Muddy River valleys. Old Lake Muddy covered a considerable portion of the Pinckneyville and Murphysboro quadrangles.

2.6 5.0 Turn right on gravel road.

0.8 5.8 STOP NO. II. Exposure of weathered Illinoian till.

After the glacial till was deposited, natural weathering began. The rate of weathering is slow, but where till remained undisturbed a soil profile developed in the upper portion of the till. The till here is deeply weathered.

Following the practice established about 30 years ago by the Russian scientist Glinka, soil scientists consider that the soil or weathering profile consists of three zones, designated

A, B, and C from the top down. The zone A is the "soil" zone, normally black or gray. The B zone is the "subsoil" zone, and the C zone is the unaltered parent material.

The zonal effect comes about because the four major weathering processes progress at different rates, although all of them depend on the downward movement of groundwater. These processes, listed according to their rate of progress and beginning with the most rapid, are: (1) oxidation; (2) leaching of carbonates; (3) decomposition of more resistant minerals; and (4) accumulation of humus.

In the A zone, in which humus material from decaying plants has accumulated, the rock minerals are oxidized, leached, and decomposed. In the upper part of the B zone the rock minerals are only oxidized (oxidation is shown by reddish or yellowish color caused by oxidation of iron minerals). The leached zone is determined by absence of carbonate rocks, such as limestone, and is revealed by tests with a solution of hydrochloric acid.

The soil profiles developed on the older drifts - Illinoian, Kansan, and Nebraskan, can be divided into five zones, designated by numbers instead of letters in order to avoid confusion. Horizon 1 is the old "soil" or humus zone. Horizon 2 is a dense layer, very gummy and plastic when wet, very hard when dry. Horizon 3 is the leached and oxidized zone, and Horizon 4 is the oxidized but calcareous zone. Horizon 5 is the unaltered parent material.

The development of five recognizable zones in the old drifts results from the fact that they are deeply weathered. Oxidation, leaching, and decomposition of minerals have all progressed deeper. Another process, the downward transfer of clay minerals has not only left Horizon 1 more silty than it was originally but has also made Horizon 2 much more dense and plastic than it was originally. This dense plastic "gumbo" horizon is known as "hardpan" and is widespread and important in southern Illinois.

0.9 6.7 STOP NO. III. West end of Burning Star No. 2 strip pit.

In this strip pit is exposed the top of the old land surface before the glaciers added their deposits of till, sand, and gravel. Note especially the north end of the pit where some of the caprock limestone was removed by erosion before the till was deposited.

The following is a typical section of the highwall in this part of the mine:

	Thickness in feet
Surface soil	1-2
Till, deeply weathered	6
Gravel lenses	0-3
Brown till, pebbly, with sand lenses	4-6
Gravel	0-8
Till, gray, with many pebbles and wood fragments	6-15
Shale, gray-brown, in part disturbed by glacier	0-½
Limestone, called the Herrin, blue-gray, dense, hard, very fossiliferous. Contains many small fossils shaped like wheat grains (fusulinids). Note evidence of solution along the joints, and that the joint cracks were filled with clay	4-6
Shale, black, well laminated, with an occasional conodont (tiny tooth-like or jaw-like fossils)	1-2
Coal, called the Herrin (No. 6). This coal bed accounts for about 70 per cent of Illinois coal production	5-6

Along the highwall observe the variation of sediments, how the glacial till follows the old irregular land surface, how the gravel lenses thicken and thin. The bedrock also changes. The limestone caprock (Herrin) was deposited in a sea, probably a clear shallow sea where many small sea animals lived. Some of their shells are included in the rock. Now the sea is a thousand miles away, yet here is evidence that the ocean once covered this part of Illinois. Later in the day we will see evidence that the ocean advanced over this area at least one other time.

In Illinois, coals are commonly overlain by black sheety shale ("roof slate") followed by limestone with marine fossils. Below each coal there is an underclay, in turn underlain by shale, then sandstone. Beneath the sandstone there are shales, then limestone, then another shale. Beneath this shale is the caprock limestone of the next lower coal.

This succession of different kinds of strata is repeated in much the same sequence some 50 times where the Pennsylvanian (Coal Measures) rocks are thickest. Each succession of Pennsylvanian rocks is called a cyclothem (see attached chart).

These different strata indicate many rapid changes of environment which took place repeatedly during the Pennsylvanian period. At that time rivers were bringing sediments from the north and east, possibly from as far away as the present Atlantic

coast. The ocean lay to the west and south - as far away as Nebraska, Oklahoma, and Texas. The country in between, which is now the Middle West, was a low flat swampy area in which the sediments were being deposited. There is no area on earth today that has conditions like those that existed during Coal Measures time.

The plants and trees that grew at that time were very luxuriant. As the plants fell into the swampy waters they were partially preserved, buried by later sediments, and converted into coal. Some times the sediments were fine silts and clays, and at still other times the sea covered the area and left marine fossils.

0.5 7.2 STOP NO. IV. Highwall along northwest-southeast face of strip pit.

Here is a constant variation of both the glacial drift and the consolidated rocks. At this stop the rocks arch gently upward into an anticline. Large structures similar to this small one may contain petroleum deep underground.

Compare the section of highwall in this part of the mine with the section exposed at Stop No. III:

	Thickness in feet
Surface soil	3
Till, deeply weathered	4-6
Till, red, sandy; possibly a deeply weathered gravel	0-6
Till, brown, weathered	0-5
Sand	0-3
Till, gray, pebbly	8-20
Gravel	0-2
Shale, very deeply weathered, possibly shoved by glacier	0-4
Shale, gray, well laminated	20-25
Coal	5-6

Notice that the black shale and limestone are not present here but that they arch up on the sides of the gray shale a short distance away. Farther east in Franklin County, the high-quality coal (low in sulfur and ash) lies under a gray shale very much like the gray shale you see here.

0.2 7.4 STOP NO. V. East end of Burning Star No. 2 strip pit.

Here again there is variation of the glacial till and bedrock. In the upper part of the coal portions of the coal, forming plants are petrified. By cleaning the material with acid and studying the petrified material, we have learned something about the kinds of plants that lived during the Pennsylvanian or Coal Measures time.

Compare this section with the other two:

	Thickness in feet
Surface soil	3
Till, Deeply weathered	12
Till, brown, pebbly	5
Sand	0-½
Till, light gray-brown	4-6
Limestone, blue-gray, thinly laminated	2
Shale, black, well laminated	2
Coal	5-6

2.4	9.6	STOP! State Highway No. 154. Turn left (west).
2.0	11.6	STOP NO. VI. LUNCH! Pinckneyville Community High School.
0.4	12.0	STOP! At southeast corner of the Court House Square. Proceed and turn left at intersection with State Highway No. 13.
3.3	15.3	Turn left from State Highway No. 13 onto the mine road of the Truax-Traer Coal Company's Pyramid Mine.
1.0	16.3	STOP NO. VII. Strip pit of the Pyramid Mine.

In this pit a surface soil is developed on the old Muddy Lake silt. This silt lies on pebbly glacial till. The upper surface of the bedrock was notched by erosion before the till was deposited.

Compare the following section with the others:

	Thickness in feet
Surface silt	15
Till, pebbly, brown	4
Shale, hard, platy, silty	3
Limestone, blue-gray, hard, fossiliferous	6-8
Shale, black, well laminated	1-2
Coal	6

1.0	17.3	STOP! State Highway No. 13. Turn left (south).
4.3	21.6	We are now crossing a portion of old Lake Muddy. The valley is wide and flat.
0.6	22.2	Turn right at mine road of the United Electric Coal Company's Fidelity Mine.
2.1	24.3	Mine office of the Fidelity Mine.
4.5	28.8	STOP NO. VIII. West end of Clinch Pit of the Fidelity Mine.

Here the glacial deposits are thin and the bedrock is rather thick. Two limestones are exposed, the lower is the Herrin limestone and the upper is the Bankston, named from an outcrop on Bankston Creek in Saline County. Both limestones show, by the fossils in them, that the sea covered this area at least twice in the distant past.

The limestone varies considerably in thickness and at one time formed the preglacial surface.

At this exposure we see the following section:

	Thickness in feet
Surface soil	8
Water-lain gravel and silt	4
Till, gray, pebbly, with limestone boulders	4-8
Limestone, buff, hard, massive	2-10
Clay-shale, green-gray	2
Shale, dark gray, carbonaceous	12-15
Shale, medium dark gray, calcareous, fossiliferous	0-2
Limestone (Herrin), blue-gray, dense, hard, and fossiliferous	4-12
Shale, dark gray-black	2-12
Coal	?

The next stop is only a few hundred feet from this spot, but the succession of rock and glacial till is different. We should remember that the time between the deposition of the bedrock and that of the glacial till is estimated to be at least 200 million years.

Illinois has no geologic deposits that belong to the latter part of the Paleozoic era, the Mesozoic, or the Cenozoic (see attached chart). If sediments were deposited during these times, they were later entirely removed by erosion so that the record has been lost.

0.8 29.6 STOP NO. IX. Clinch Pit of the Fidelity Mine.

Note that here, within a few hundred feet of Stop No. VIII, the greater part of the overburden above the coal is glacial drift. Here the preglacial surface had a relief of at least 50 feet. The section is as follows:

	Thickness in Feet
Soil, gray-brown	1½
Soil, tan	3

	Thickness in Feet
Till, weathered, oxidized	1
Till, brown	3
Till, brown and gray, gravelly	18-20
Sand or gravel	0-1
Till, brown and gray, quite gravelly, with wood fragments	2
Till, gray, gravelly	1
Silt, medium gray, with an occasional small pebble	6-8
Silt, brown-gray, with wood fragments	2
Silty clay, brown and green, with small nodules, appears to be a residual material	4
Shale, weathered, olive-green, a residual material	2
Shale, gray, well laminated	6
Coal	7

Here the coal is arched into an anticline in the same way as at the Burning Star No. 2 pit.

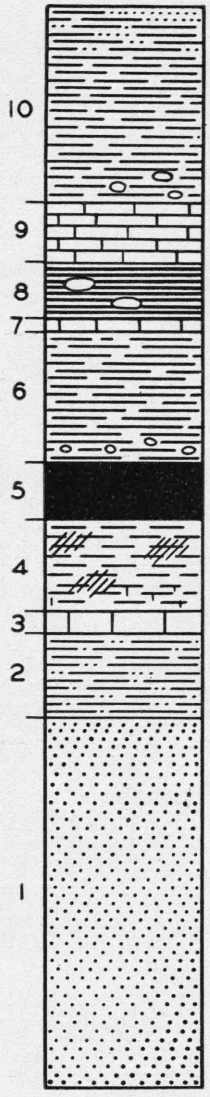
The lower part of the glacial material here is probably an isolated remnant of a till older than the Illinoian - probably Kansan in age.

Return 1.7 miles to the blacktop road.
Turn right, 1 mile to State Highway No. 13.

THE END! THANKS FOR COMING!

GEOLOGICAL COLUMN - Pinckneyville Area

ERAS		PERIODS	EPOCHS	REMARKS
Cenezoic "Recent Life"	Age of Mammals	Quaternary	Pleistocene	Recent post-glacial stage Wisconsin Loess? Illinoian glacial drift. Kansan glacial drift. Nebraskan glacial drift.
		Tertiary	Pliocene Miocene Oligocene Eocene Paleocene	Not present in Pinckneyville area.
Mesozoic "Middle Life"	Age of Reptiles	Cretaceous		Not present in Pinckneyville area
		Jurassic		Not present in Illinois
		Triassic		Not present in Illinois
Paleozoic "Ancient Life"	Age of Amphibians and Early Plants	Permian		Not present in Illinois
		Pennsylvanian	McLeansboro	Not present
			Carbondale	Herrin ls. and coal No. 6
			Tradewater	Present at depth
		Mississippian	Chester (Upper Mississippian)	Sandstones, limestones, and shales in deep wells.
			Iowa (lower Mississippian)	Limestone, shale, and sandstone, in deep wells.
	Age of Fishes	Devonian		Black shale and limestone, in deep wells.
	Age of Invertebrates	Silurian		Limestone.
		Ordovician		Shale, limestone, and sandstone.
		Cambrian		No data available.
Proterozoic Archeozoic		Referred to as "Pre-Cambrian" Time.		No data available.



10. Shale, gray, sandy at top; contains marine fossils and ironstone concretions especially in lower part.

9. Limestone; contains marine fossils.

8. Shale, black, hard, laminated; contains large spheroidal concretions ("Niggerheads") and marine fossils.

7. Limestone; contains marine fossils.

6. Shale, gray; pyritic nodules and ironstone concretions common at base; plant fossils locally common at base; marine fossils rare.

5. Coal; locally contains clay or shale partings.

4. Underclay, mostly medium to light gray except dark gray at top; upper part noncalcareous, lower part calcareous.

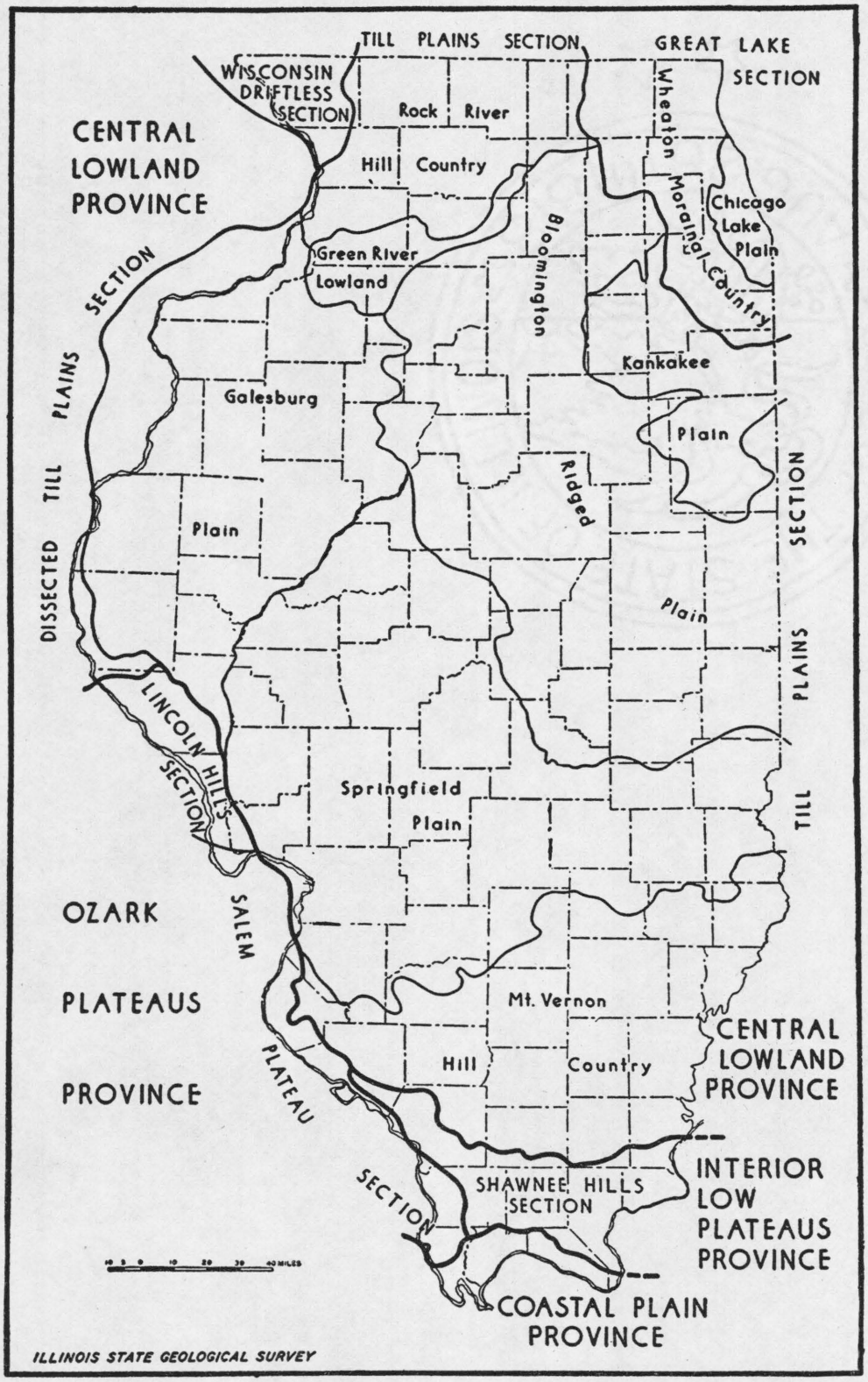
3. Limestone, argillaceous; occurs in nodules or discontinuous beds; usually nonfossiliferous.

2. Shale, gray, sandy.

1. Sandstone, fine-grained, micaceous, and siltstone, argillaceous; variable from massive to thin-bedded; usually with an uneven lower surface.

AN IDEALLY COMPLETE CYCLOTHEM

(Reprinted from Fig. 42, Bulletin No. 66, Geology and Mineral Resources of the Marseilles, Ottawa, and Streator Quadrangles, by H. B. Willman and J. Norman Payne)



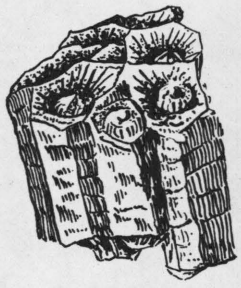
PHYSIOGRAPHIC DIVISIONS OF ILLINOIS

(Reprinted from Report of Investigations No. 129, Physiographic Divisions of Illinois, by M. M. Leighton, George E. Ekblaw, and Leland Horberg)

COMMON TYPES of ILLINOIS FOSSILS

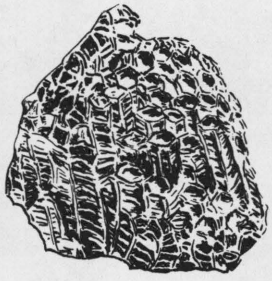
GRAPTOLITE

Cup coral

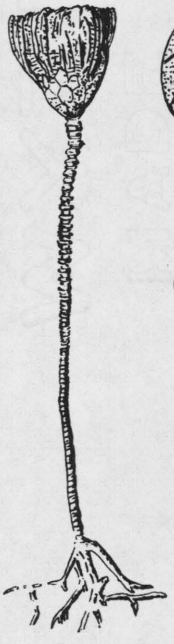


Lithostrotion

CORALS

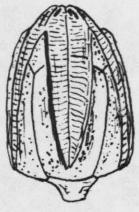


Honeycomb coral

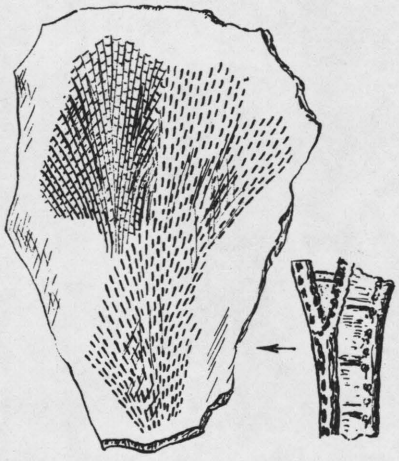


CRINOID

CYSTOID

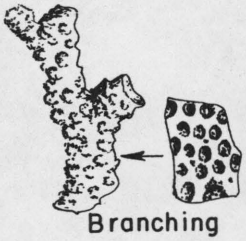


PENTREMITE



Fenestella

Archimedes



Branching

BRYOZOA

Composita

Lingula

Orbiculoidea

Spiriferoid

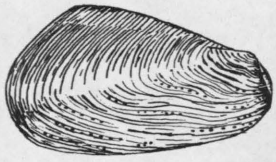
Productoid

Pentameroid

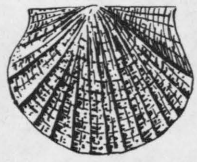
BRACHIOPODS

M.M.C.

COMMON TYPES of ILLINOIS FOSSILS



"Clam"

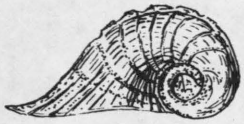


"Scallop"

PELECYPODS

High- spired

Low - spired



Flat - spired

GASTROPODS

Curved cone

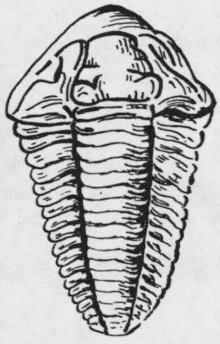
Straight cone

Coiled cone
(Nautilus)

CEPHALOPODS

Bumastus

Calymene
(coiled)



Calymene
(flat)

TRILOBITES

OSTRACODS
(greatly enlarged)

M.M.C.

PINCKNEYVILLE AREA
OCTOBER 16, 1954